CIRAD

Centre
de coopération
internationale
en recherche
agronomique
pour le
développement

Département
des cultures
pérennes
CIRAD-CP

RAPPORT DE MISSION A NAIROBI (KENYA)

Participation au séminaire annuel de l'ICRAF APR

19 - 30 septembre 1994

E. Penot

12, square
Pétrarque
75116 Paris
France
téléphone :
(1) 45 53 60 25
télécopie :
(1) 45 53 68 11
télex :
645491 F

EPIC-SIRET
331 596 270 00024

RAPPORT DE MISSION A NAIROBI (KENYA)

Participation au séminaire annuel de l'ICRAF APR

19 - 30 septembre 1994

E. Penot

CP 291/94

1 Présentation générale du programme APR 1994.

Introduction sur l'ICRAF

L'ICRAF est crée en 1978 comme une organisation de conseil, d'information et de coordination sur l'agroforesterie, puis a été intégré au CG système comme centre de recherche international sur l'agroforesterie en 1991, avec un mandat de recherche sur l'agroforesterie en général. En 1994, l'ICRAF regroupe 391 personnes dont 80 chercheurs répartis en 4 programmes de recherche.

Introduction sur l'APR

L'APR est le séminaire annuel de l'ICRAF ou tous les chercheurs, y compris les chercheurs associés, participent aux activités suivantes :

- présentation des principaux résultats de l'année en cours. Ces "highlights" sont compilés par les chefs de programmes puis ensuite publiés dans le rapport annuel de l'ICRAF. Celui de 1993 vient de sortir. Le rapport annuel est considéré comme très important par la direction ICRAF comme étant le document principal présenté aux bailleurs de fonds de l'institution. Un haut niveau de qualité est donc requis.

- présentation de tous les programmes et leurs résultats en réunion plénière.

- présentation et discussions sur les programmes d'activités et les priorités de recherche pour l'année à venir.

- participation à des sessions de discussions sur des thèmes préalablement identifiés (brainstorming sessions). Les quatre thèmes pour 1994 ont été :
    - les essais en milieu paysan.
    - estimation de l'impact des technologies
    - durabilité des activités de dissémination
    -

- sessions de travail sur les problèmes administratifs et organisationnels. Présentation du logiciel de modélisation des systèmes (Stella) et de la base de données des essais en cours. Discussion sur les problèmes de fonctionnement des chercheurs associés à l'ICRAF.

- réunion sur l'évaluation des performances des chercheurs.

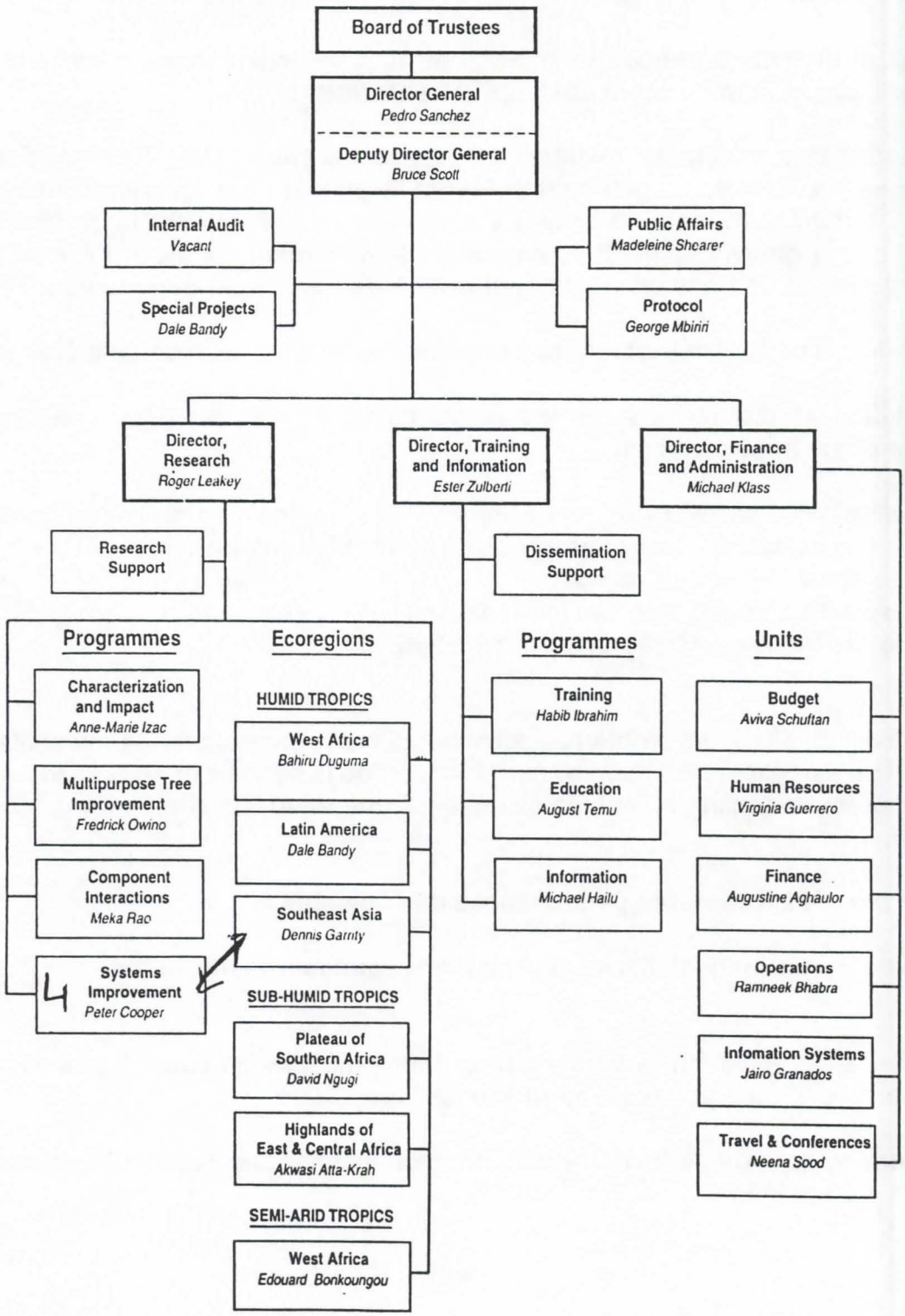
- réunion de travail, présentation et discussion des budgets de recherche pour l'année à venir.

- une journée de visite sur le terrain des expérimentations en cours à la station de recherche ICRAF de Machakos, et au site de Mua Hills.

Le programme général de travail, étalé sur deux semaines, est présenté en annexe 1.

Tableau 1

ORGANIZATIONAL STRUCTURE



Rapport de mission à Nairobi (Kenya)

Participation au séminaire annuel de l'ICRAF APR

19 - 30 septembre 1994

E. Penot

CP 291/94

Liste de diffusion

Novembre 1994

. Marie de Lattre-Gasquet	1 ex
. P. Safran	1 ex
. JL. Renard	1 ex
. D. Picard	1 ex
. J. Meunier	1 ex
. P. Gener	1 ex
. H. Omont	1 ex
. D. Nicolas	1 ex
. C. Daniel	1 ex
. JL. Jacob	1 ex
. JM. Eschbach	1 ex
. A. Gouyon	1 ex
. H. Manichon	1 ex
. Y. Banchi	1 ex
. H. de Livonnière	1 ex
. JL. Muron	1 ex
. P. Durand	1 ex
. J. Imbernon	1 ex
. E. Penot	2 ex
. SIC	2 ex

- création d'un groupe de travail sur les agroforêts avec définition d'un programme de travail sur les points suivants :

- a) définition et caractérisation des "multistrata systems", incluant les agroforêts.
- b) typologie des systèmes.
- c) évolution des systèmes de l'agriculture itinérante aux agroforêts.
- d) définitions des axes de recherche sur les innovations techniques et les politiques sur ces systèmes.
- e) méthodologie de recherche.
- f) identification des priorités de recherche.

Le groupe E Penot/T Tomish sera plus particulièrement chargé des point c, d et e.

Le programme général de travail, étalé sur deux semaines, est présenté en annexe 1.

2 les programmes de travail à l'ICRAF.

L'ICRAF a réparti ses activités dans 7 programmes dont quatre de recherche (voir tableau 1 organizational structure). Le détail des programmes est présenté en annexe 2.

- *Programme 1 : Caractérisation et impact* :

  - 1.1 Caractérisation des systèmes et environnement.
  - 1.2 Expérimentation des technologies/Innovations.
  - 1.3 Politiques de recherche
  - 1.4 Analyse de l'impact de ces technologies et recommandation.

Ce programme est essentiellement un programme à forte composante socio-économique qui doit, outre l'identification et la Caractérisation des systèmes (de culture et de production), doit estimer l'adoptabilité des innovations, leur impact, et identifier les éléments d'une politique de recherche.

- *Programme 2 : amélioration des MPT : MultiPurpose Trees : arbres à usages multiples.*

  - 2.1 MPT germplasme
  - 2.2 Provenance et évaluation des espèces MPT.
  - 2.3 Amélioration des MPT

Ce programme, plutôt orienté technique, porte sur l'identification et l'évaluation des MPT.

- *programme 3 : Composantes et interactions.*

  - 3.1 Compétition et croissance.
  - 3.2 Gestion des nutriments.
  - 3.3 Conservation des sols.
  - 3.4 Gestion phytosanitaire.

Ce programme , lui aussi très technique, est axé sur les relations eau-sol-plante, fertilité des sols et effets des problèmes phytosanitaire sur les cultures associées au sein des systèmes agroforestiers.

- *Programme 4 : Amélioration des systèmes de culture.*
Ce programme est essentiellement divisé en sous régions géographiques de même nature agro-écologique.

  - 4.1 Highlands sub-humides de l'Afrique centrale et de l'Est.
  - 4.2 Plateau sub-humide de l'Afrique Est-Sud.
  - 4.3 Zones semi arides de l'Afrique de l'ouest (SALWA).
  - 4.4 Zones humides de l'Afrique de l'ouest (HULWA).
  - 4.5 Zones tropicales humides de l'Amérique latine.
  - 4.6 Zones tropicales humides de l'Asie du sud-est.

Mon poste est relié au programme 4.6, (amélioration des systèmes de cultures, et Asie du Sud-est). Le responsable du programme 4 est Peter Cooper. Voir les caractéristiques du programme 4 en annexe 3. Une présentation du programme 4.6 (Asie du Sud-Est), issue du rapport annuel 1993 est présenté en annexe 5.

3 Points particuliers.

La place du SRAP entre les programmes 1 et 4

Le projet SRAP est officiellement relié au programme 4, mais de nombreux aspects du projet sont également reliés au programme 1, en particulier pour la Caractérisation des systèmes de production dans les zones nouvelles d'études (West-kalimantan et Jambi, Sud-Sumatra ayant été étudié par A Gouyon 1988-1991), et en ce qui concerne l'adoptabilité des systèmes RAS, estimation de l'impact..... La responsable du programme 1 est française (Anne Marie Izac)

Le SRAP et ASB (Alternatives for Slash and Burn programme,)

Le SRAP va démarrer ses activités sur deux zones : West-Kalimantan, sur financement local GAPKINDO (13 000 US $), et Jambi, sur financement ASB. ASB, Alternatives for Slash and Burn programme, est un gros programme de recherche,

The Alternatives to Slash-and-Burn (ASB) Programme is a global initiative designed to formulate a research and development strategy that will provide workable alternatives to unsustainable slash-and-burn agriculture worldwide. The programme involves a consortium of several international research centres and national research systems as well as local and international non-governmental organizations. Research on the biophysical and socioeconomic aspects of slash-and-burn, which will be conducted at selected benchmark sites in Africa, Latin America and Asia by a multidisciplinary team from the ASB consortium, provides the basis for developing and disseminating alternative sustainable production systems for the affected areas.

One of the objectives of the programme's research strategy is to develop research tools for socioeconomic and biophysical research and to test and validate the alternative technologies and policies developed. The methodologies and the presentation of data need to be standardized for all benchmark sites. As part of the regional characterization, the programme is developing a georeferenced database on the socioeconomic and biophysical factors, and this requires uniform data collection and presentation. Using the Geographic Information System (GIS) will assist in diagnosis and also in determining how data can be extrapolated to other agroecological zones and farming systems. By using similar methods and standardizing the presentation of data, results can be compared and extrapolated across sites and regions. Recommendations can be extended from sites to regions and the world.

The Research Methodology Workshop was convened so that ASB consortium scientists could review and establish common and standardized research methodologies that could be used at the different benchmark sites. During the workshop, the scientists carried out a field exercise in West Sumatra, Indonesia, using a 'hands-on' approach to test some of the methodologies for biophysical and socioeconomic characterization. Given the diversity of disciplines, the different scales of operation and the variation in biophysical and socioeconomic environments of the research sites, a common research methodology is necessary to make the initiative truly global.

As the ASB programme is focused on a highly interactive resource system, the research methodology developed on land-use systems must be one that is acceptable to the multidisciplinary team involved. This will ensure that the environmentally oriented technologies designed are linked with socioeconomic policies that will provide incentives for such technologies and disincentives against further deforestation.

This proceedings also reflects the joint effort of the CGIAR, NARS and NGOs towards the development of a global research and development strategy that will address global environmental issues as well as socioeconomic problems affecting small-scale farmers associated with tropical deforestation. As the ASB programme progresses, it is hoped that the scientists involved will continue to review and refine their research methodologies so as to maintain the coherent approach needed in this global strategy.

Dale Bandy
ASB Coordinator

financé par UNDP/GEF, destiné à financer les activités de recherche des chercheurs nationaux associés au projet. Dans le cas du SRAP, 4 chercheurs indonésiens, deux de AARD/CRIFCI/Sitiung/West-Sumatra et 2 de IRRI/Sembawa/Sud-Sumatra travailleront sur l'établissement et le suivi des essais SRAP sur la province de Jambi sur ce budget. On peut raisonnablement attendre un montant de 30 à 40 000 US $/an pour le SRAP (sur un montant de 400 000 US $ pour ASB Indonésie). Un document de travail avec un budget pour 1994 et 1995 a été réalisé en mai 1994.
Le budget ASB transite par les institutions nationales, à savoir pour le SRAP par le Ministère des Forêts (qui accueille l'ICRAF à Bogor). Le correspondant indonésien de ce programme est Mr Gintings.
Le responsable pour l'ensemble du projet ASB/ICRAF est Dale Bandy (basé à Nairobi). Le projet ASB est un gros projet fédérateur qui inclue d'autres centres du CG système et des instituts de recherches nationaux (NARS pour National Agricultural Research System). Les objectifs de ASB sont rapidement présentés en annexe 4. La phase I du projet (Caractérisation) est financée mais il semble qu'il y ait quelques difficultés à attendre pour la phase II.

Le SRAP dans la problématique ICRAF

La problématique ICRAF relève essentiellement de la promotion de l'arbre au sein des systèmes de cultures annuelles, en favorisant les aspects conservation ou réhabilitation des sols, maintien de le fertilité dans un processus de fixation de l'agriculture et utilisation d'arbres à usages multiples (les MPT's Multi purpose trees) : fertilité des sols, apport de matière organique, fourrages, bois de feu.....
Différentes technologies ont été testées, essentiellement en station, ou en point d'appui en milieu paysan en situation contrôlé : alley-cropping, relay cropping, hedgerow systems, jachère améliorée....Ces technologies sont testées en Afrique, en Amérique du Sud (Brésil et Pérou) et en Asie du Sud-est (Indonésie et Philippines)
En Indonésie, on trouve de nombreux systèmes agroforestiers complexes, définis par H de Forresta, ou l'arbre, généralement de grande taille (les MPT sont des arbres de petite taille testés dans des systèmes plutôt relativement secs ou d'altitude), est la composante principale. L'association dans de tels systèmes réside dans l'association entre arbres, et non entre arbres et cultures annuelles, sauf pendant le période d'installation et/ou immature de certains arbres, dont l'hévéa. Cette problématique est donc nouvelle pour l'ICRAF.
L'originalité du SRAP réside dans le fait que ces systèmes agroforestiers complexes, dont naturellement le jungle rubber, sont déjà cultivés, à une très large échelle par les paysans, ce qui n'est pas le cas des technologies développées par ICRAF, ou le problème de l'expérimentation réelle en milieu paysan n'a pas encore été réalisée à échelle significative pour en mesurer l'adoptabilité par les paysans. Les systèmes RAS constituent donc une alternative de recherche très intéressante et totalement différente des travaux habituels de l'ICRAF. Les travaux réalisés en Asie du Sud-Est sur les agroforêts complexes permettent à l'ICRAF d'intégrer sur le plan pratique à leur problématique la composante "agroforêt" sur le terrain.
L'ICRAF est un centre de recherche international qui, par conséquent, a vocation à

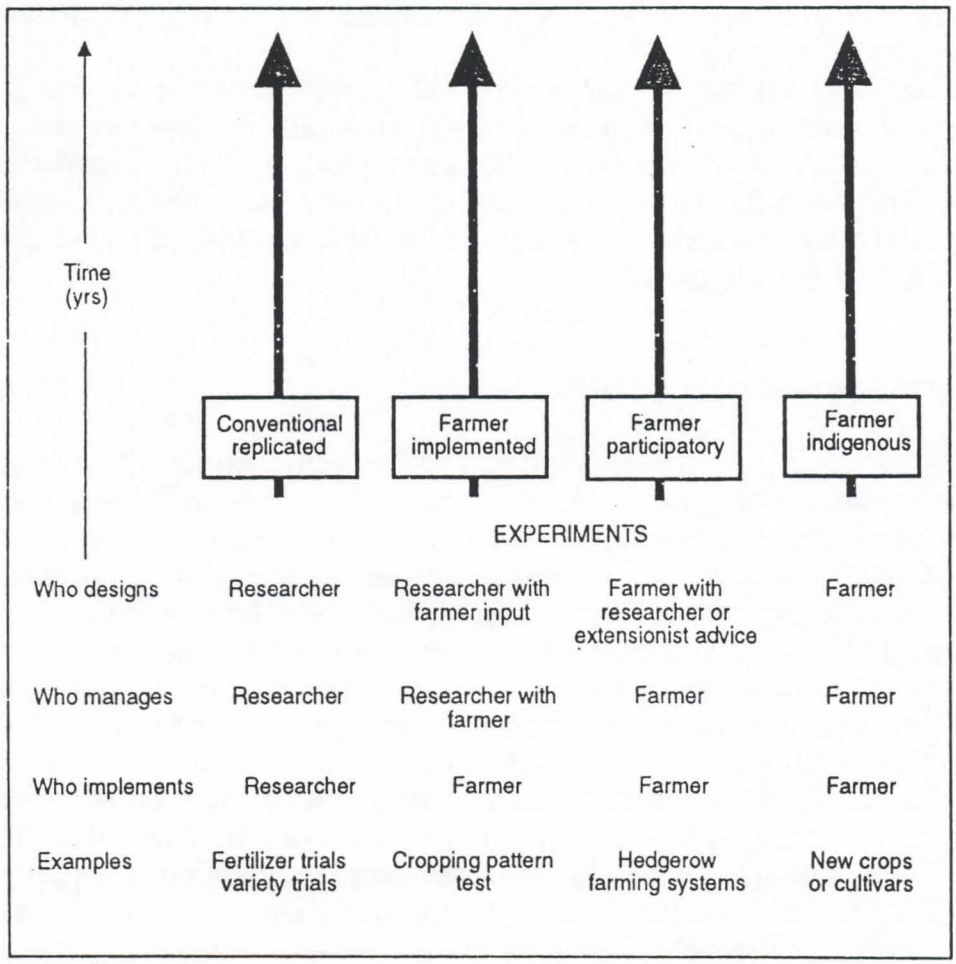


Figure 3. Major streams or modes of on-farm research (Garrity 1993)

globaliser un certain nombre de champs de recherche. L'accent est donc mis, outre la réalisation d'expérimentation et d'enquêtes sur le terrain, sur les perpectives globales d'une action de recherche, qui peut dépasser le cadre strict de la méthodologie de départ sur l'amélioration des jungle rubber.

ICRAF et l'expérimentation en milieu paysan.

La définition ICRAF des essais en milieu paysan (EMP) est différente de celle classiquement utilisée au CIRAD. Le CIRAD entend par EMP des essais en milieu réel, réalisé par le paysan, avec un but opérationel de mesure de l'adoptabilité d'une innovation. C'est ce genre d'essais qui seront menés au SRAP. L'ICRAF définit comme EMP un essai qui a lieu sur un terrain appartenant au paysan, en situation totalement contrôlé, ou en association avec le paysan avec différente degré de participation (voir tableau n° 2 ci-contre). La plupart des essais EMP réalisés par l'ICRAF sont en situation contrôlée (dont beaucoup avec une composante d'étude biophysique très marquée), et donc, ne peuvent permettre de juger de l'intérêt d'une innovation par les paysans ou de tester son niveau d'adoptabilité. Les EMP, réalisés et gérés par les paysans sont notés comme "participatory OFT" (on-farm trial). Il apparait intéresser de développer ce type d'essais avec l'ICRAF, d'une part parce que ils sont bien adaptés à la problématique du SRAP, et, d'autre part, parce que l'ICRAF a besoin de développer un réseau d'expérimentation qui lui permette vraiment de déboucher sur des résultats opérationnels, réellement testés en milieu réel.

Le sous-programme régional Asie du sud-est

Le sous programme est représenté en annexe 4. En terme de chercheurs disponible au programme à Bogor, tous les domaines d'activité sont couverts (aspects biophysiques et relation eau-sol-plante, aspects économiques et politiques de recherche te de développement, expérimentation en station et en milieu paysan, SIG.....) et une multidisciplinarité de fait s'installe en particulier pour le SRAP. Le contexte humain et scientifique est donc particulièrement favorable à un travail en équipe. Lors d'une réunion finale entre le programme Asie du sud-est et Mr Pedro Sanchez, directeur ICRAF, Mr Sanchez nous a renouvelé son intérêt pour la dynamique en cours dans le programme Asie du Sud-Est. L'ICRAF ouvre pleinement ses portes aux chercheurs associés qui sont considérés comme partie intégrante du personnel ICRAF et nous invite à utiliser tous les services dont nous serions appelés à utiliser (service qualité sur les expérimentations en cours, service publications et traduction, support statistiques, service documentation.....)

ANNEXE 1

PROGRAMME APR 1994

ICRAF
International Centre for Research in Agroforestry

MEMORANDUM

TO: All ICRAF Professional Staff

FROM: Roger Leakey, Director Research
Ester Zulberti, Director Training and Information
Michael Klass, Director Finance and Administration

DATE: 13 August, 1994

SUBJECT: Annual Programme Review (APR)
19 September - 30 September 1994
Nairobi, Kenya

Please find attached, for your information and planning, the agenda for APR (Annex 1). Like in previous years, during these two busy weeks we will attempt:

1) to review programme highlights, achievements and limitations.
2) to discuss programme plans.
3) to discuss administrative and management procedures
4) to conduct performance evaluation for 1994 and budgeting

As in previous years, there will be a ***sundowner*** at ICRAF House on Sunday, 18 September from 5.30 to 7.00 p.m. for all outreach and professional staff and spouses.

HIGHLIGHTS FOR WEEK 1

Briefing of regional strategies & systemwide initiatives (Monday 19)

The objective is to inform staff of the conceptual framework for research and dissemination in your region and the major objectives and activities at each site. Each talk will be **strictly** limited to 15 minutes, allowing only 5 minutes for questions. Slides are welcome to illustrate landuse, topography, etc.

Highlights 1994 (Monday 19 and Tuesday 20)

Programme meetings will take place (simultaneously) to discuss agreed research and dissemination highlights for the 1994 annual report. Staff in programmes 5-7 will join the meetings of the research programmes.

United Nations Avenue, Gigiri; P.O. Box 30677, Nairobi, Kenya
Telephone: (254-2) 521450; Telefax: (254-2) 521001; Telex: 22048 ICRAF; Cable: ICRAF; E-Mail: CGNET CGI:236

RCD 23/8 94

Performance Evaluation 1994 (Wednesday 28 and Thursday 29)

In response to staff suggestions, we have revised the 1994 performance evaluation form. It is simpler and hopefully easier and quicker to complete, without loosing any of its effectiveness as an instrument to evaluate staff performance. The form is attached in Annex 3. Please complete part A of your own form well before APR and send/give it to your supervisor as soon as possible, so that he/she can start to fill in the form before APR. In other words, the time allocated to evaluations during APR should be for completing the process, not for starting it. The two days set aside for this activity do not preclude staff from meeting on this matter at other times during APR. Performance evaluation will run concurrently with budgeting (see below). Regional and Programme Coordinators must coordinate their respective schedules for both.

Budgeting (Wednesday 28 and Thursday 29)

Budgeting forms and instructions will be sent by FINAD during August 1994.

Presentation of Programme of Work for 1995 (Friday 30)

The sequence and time distribution for programme presentations 1-7 will be as indicated in the agenda.

Please note that the official end of APR will be with **Programme 8** *Chez Sanchez!* Everybody is invited to a dinner dance in national dress.

Administration and logistics

The Divisional Administrators and the Travel and Conference Unit are behind the APR administration and logistics. Office space and secretarial support has been allocated to outreach colleagues (Annex 4). International travel, accommodation, local travel and catering arrangements are being handled by Sam, Mamouda, Geeta and Milcah.

Please do not forget to bring with you all relevant material which has been included in this information package:

- Annex 1 - Agenda for APR 1994
- Annex 2 - Plan of Work
- Annex 3 - Performance Evaluation Form
- Annex 4 - APR Room & secretarial support allocation

Do not hesitate to contact any one of us should you require further details or additional information. Thanks for your contribution.

WE LOOK FORWARD TO AN EXCITING, BUSY AND EXCELLENT APR 1994!!

Presentation of research & dissemination highlights (Wednesday 21)

Emphasis here is on highlights, just 2-3 overheads/slides per project of the most exciting results. This is not to be an attempt to present everything that has been done. Datasets should be pruned down to those making the specific point being presented.

Field trip to Machakos Research Station (Thursday 22)

We will spend the whole day at Machakos. All professional staff are expected to participate. Departure is planned at 8.30. A programme will be circulated later on.

Programme of Work 1995 (Friday 23)

Again, individual programme meetings will take place to develop the research and dissemination Programme of Work 1995. This should result in the formulation of the final POW 1995 to be presented to the Board in late November 1994. The format for this presentation should follow that developed after the March meeting of the Board of Trustees in 1993 (Annex 2). Everyone to attend the meetings of the programme to which they are attached. Contributions to other programmes should have been made earlier, e.g., regional planning meetings. Programme Coordinators in TID will meet Regional Coordinators on Friday afternoon to discuss issues related to the regional scope of the programmes.

Sports Day (Saturday 24)

We hope you are already training for this traditional annual event at ICRAF! The Sports Day and barbeque will be organized at the BP Shell Club and will run approximately from 10.00 a.m. to 5.00 p.m. A separate programme will soon appear in Telicraf.

HIGHLIGHTS FOR WEEK 2

Brainstorming (Monday 26)

topic 1 : OFR on-farm experimentation.
topic 2 :

Four sessions on research and dissemination topics. Each session will be introduced by a 15-minute presentation on a cross-cutting topic followed by comments and discussion between 4-6 panel members (5 minutes each/panel member) aimed at stimulating new ideas for research and dissemination. Thereafter, the topic is open to brainstorming from the floor for 60 minutes. The presenter of each topic will steer the brainstorming and keep a record of the major points arising. Two topics have already been identified: "on-farm research" and the "sustainability of dissemination activities". Suggestions for the other two are welcome.

Organizational Matters (Tuesday 27)

This is an opportunity to raise issues on administration and management that need to be discussed within ICRAF, i.e., communications, performance evaluations, terms of employment, etc. These issues should be general in nature and not grievances with individual staff members. Staff will be given an opportunity to suggest items for the agenda early on during the first week of APR.

+ 1 meeting for ICRAF newcomers : presentation, pubs, organization.

(First Week)

TIME	MON 19/9/94	TUE 20/9/94	WED 21/9/94	THUR 22/9/94	FRI 23/9/94	SAT 24/9/94
0900 0915 0930 0945 1000 1020	<u>Opening session</u>: • Sanchez • Scott • Leakey • Zulberti <u>Briefing of Regional Strategies (research and dissemination)</u> • SALWA - Bonkoungou • HULWA - Duguma (Cameroon) Humid tropics. *Chair: Scott*	<u>Programme meetings</u>: (continued discussion of 1994 highlights) Nichola Tanner Programme 4: Peter Cooper	<u>Plenary meeting</u>: Presentation of research and dissemination highlights 1994 0900 Prog 1 - Izaac (Environment Economics) 1000 Prog 7 - Hailu *Chair: Scott*	08.30 Departure MACHAKOS *Leader: Rao*	<u>Programme meetings</u>: Programme of work 1995 Programme 4.	SPORTS
	Coffee Break					
1100 1120 1140 1200 1220 1240	• E&C Africa - Atta-Krah (Africa) • S Africa - Ngugi • L America - Bandy • S E Asia - <u>Garrity</u> <u>Briefing on Systemwide Initiatives</u> • ASB - Bandy • HI - Scott *Chair: Sanchez*	LEROY PENG 11h00 SRAP presentation.	1115 Prog 2 - Leakey 1215 Prog 6 - Temu *Chair: Zulberti*	FIELD TRIP	E PENG: SRAP programme 16h00	DAY
	Lunch Break					
1400 1500 17h00 ?	<u>FINAD Session</u>: Klass *Chair:Scott* <u>Programme meetings</u>: 1994 Highlights for Annual Report ETH *Chairs: Prog. Coord. 1-4*		1400 Prog 3 - Rao 1500 Prog 5 - Ibrahim 1600 Prog 4 - <u>Cooper</u> *Chair: Leakey*		Meeting of TID with Regional Coordinators *Chair: Zulberti*	*Chair: Kiio*

Programme 4: "Systems improved" Peter Cooper.
Programme 1: "Environment < policy" Anne-Marie Izac

General support: Hasham and Mbindyo

AGENDA FOR APR 1994
(Second Week)

TIME	MON 26/9/94	TUE 27/9/94	WED 28/9/94	THUR 29/9/94	FRI 30/9/94	SAT 1/10/94
	Plenary meeting Brainstorming sessions: Topic 1 - On-farm research	Plenary meeting Organization Matters - Consolidation - Internal concerns - IPSA - Other issues?	Performance Evaluations and Budgeting SROP Budget 94&95.	Performance Evaluations and Budgeting	Plenary meeting Presentation of Programme of Work 1995	
0900	Presentation	- Cash flow			0900 Prog 1 - Izaac	
0915	Panel discussion					
0945	Floor discussion		(all day)	(all day)	1000 Prog 2 - Leakey	
1045			Coffee Break			
	Topic 2 - Sustainability of Dissemination Activities		Clone Files Index		1100 Prog 3 - Rao	
1100	Presentation				1200 Prog 4 - Cooper	
1115	Panel discussion					
1145	Floor discussion					
	"Informal meeting on Marketing"		Lunch Break			
	Topic 3 (to be defined)				1400 Prog 5 - Ibrahim	
1400	Presentation					
1415	Panel discussion				1500 Prog 6 - Temu	
1445	Floor discussion				1600 Prog 7 - Hailu	
1545	Coffee				1700 Closing APR - Sanchez	
1600	Topic 4 (to be defined)				1930 Prog 8 - *Chez Sanchez in indigenous attire*	
1615	Presentation					
1645	Panel discussion Floor discussion					

General support: Hasham and Mbindyo

PLAN OF WORK (Year)

1

1. Programme Overview

2. Individual Project Descriptions

3. Programme Outputs

PROGRAMME OVERVIEW 2

(i) Programme Title:
(ii) Programme Coordinator:
(ii) Programme Aims:
(iv) Programme Description:
(v) Programme Desired Outcomes

} Derived from Mid Term Plan (but updated annually)

(vi) List of Projects:
(vii) Senior Scientist Years:
(viii) Funding of Projects:
(ix) Programme Funds:
(x) Research/Dissemination Achievements (Outcomes)
(xi) Planned Transfer to Clients and Implementation:

PROJECT DESCRIPTIONS 3

(i) Project Title:
(ii) Project Leader:
(iii) Project Objectives:
(iv) Expected Duration of Project:

} Fixed for life of Project

(v) Project Staffing:
(vi) Collaboration (internal and external):
(vii) Sources and Amount of Funds:
    (a) unrestricted
    (b) restricted
(viii) Research/Dissemination achievements against key tasks of previous year
(ix) Key tasks/activities for year (with locations of the tasks)

PROGRAMME OUTPUTS

(i) Programme's Scientific Output:

(a) Publications

- books
- papers in refereed journals
- papers in conference proceedings
- book chapters
- extension papers
- training manuals
- others

(b) Others

A. Scientific Outputs
B. Solutions to Development Problems

ANNEXE 2

PRESENTATION DES 4 PROGRAMES DE RECHERCHE ICRAF

ICRAF'S PROGRAMMES AND PROJECTS & PEOPLE

RESEARCH DIVISION	**ROGER LEAKEY**
Programme 1: Characterization and Impact	**Anne-Marie Izac**
Project 1.1: Environmental Characterization and Analysis	Steve Franzel
Project 1.2: Technology Testing and Evaluation	Keith Shepherd
Project 1.3: Policy Research	Frank Place
Project 1.4: Recommendation and Impact Analysis	Anne-Marie Izac
Programme 2: Multipurpose Tree Improvement	**Tony Simons**
Project 2.1: MPT Germplasm Resource Centre	*Doug Boland*
Project 2.2: Species and Provenance	Jumanne Maghembe (Malawi)
Project 2.3: Tree Improvement	Fred Owino
Programme 3: Component Interactions	**Meka Rao**
Project 3.1: Interactions for Growth Resources	Chin Ong
Project 3.2: Nutrient Management	Roland Buresh
Project 3.3: Soil Conservation	Julio Alegre (Peru)
Project 3.4: Insect Pest and Weed Management	Meka Rao
Programme 4: Systems Improvement	**Peter Cooper**
Project 4.1: Subhumid Highlands of East and Central Africa	Don Peden (Uganda)
Project 4.2: Subhumid Plateau of Southern Africa	Freddie Kwesiga (Zambia)
Project 4.3: Semiarid Lowlands of West Africa	Mamadou Djimdé (Senegal)
Project 4.4: Humid Lowlands of West Africa	Bahiru Duguma (Cameroon)
Project 4.5: Humid Tropics of Latin America	*Dale Bandy*
Project 4.6: Humid Tropics of Southeast Asia	Dennis Garrity (Indonesia)
TRAINING AND INFORMATION DIVISION	**ESTER ZULBERTI**
Programme 5: Training	**Habib Ibrahim**
Project 5.1: Human Resource Development	Habib Ibrahim
Project 5.2: Training Materials	Jan Beniest
Programme 6: Education	**August Temu**
Project 6.1: Education in Africa	August Temu
Project 6.2: Education in Latin America and Southeast Asia	Ester Zulberti
Programme 7: Information	**Michael Hailu**
Project 7.1: Documentation	Peer review → Michael Hailu
Project 7.2: Publications	Helen van Houten
FINAD	**MICHAEL KLASS**
OFFICE OF THE DIRECTOR GENERAL	**PEDRO SANCHEZ** **BRUCE SCOTT**

Programme 1: Characterization and Impact

Project 1.1 Environmental Characterization

Objective

Characterize priority environments and land-use systems and identify constraints and opportunities for research in other ICRAF programmes

Project 1.2 Technology Testing

Objective

Evaluate the adoption potential of new and/or improved agroforestry technologies at key sites and develop models that integrate biophysical and socioeconomic factors of farmers' decision-making processes

Project 1.3 Policy Research

Objective

Develop an understanding of how selected policies constrain or support the adoption of agroforestry technologies and, in collaboration with national partners, advise governments and other institutions on the policy options and mechanisms that will facilitate technology adoption

Project 1.4 Impact Analysis and Recommendations

Objective

Measure the impact of key technologies on agricultural sustainability, rural poverty, farmers' welfare, natural resource and environmental preservation and global climate change; and develop recommendations on the basis of this information

Programme 2: Multipurpose Tree Improvement

Project 2.1 Multipurpose Tree Germplasm Resource Centre

Objective

Explore, collect, characterize, document and conserve germplasm of priority species and facilitate the supply and exchange of research quantities of germplasm to collaborating institutions

Project 2.2 Species and Provenance Evaluation

Objective

Evaluate a wide range of indigenous and exotic species that have potential roles in agroforestry technologies for their adaptability to constraining environmental conditions, compatibility with companion crops, productivity, and their response to various tree-management practices

Project 2.3 Multipurpose Tree Improvement

Objective

Develop methods for selecting and breeding no more than five multipurpose tree species for priority agroforestry technologies in each ecoregion

Programme 3: Component Interactions

Project 3.1 Competition for Growth Resources

Objective

For a representative range of environments, quantify the processes and determine the mechanisms that limit growth when trees and crops compete for resources

Project 3.2 Nutrient Management

Objective

Quantify the various processes by which trees improve the cycling of nutrients, maintain soil organic matter, ameliorate problem soils, and contribute to efficient nutrient management

Project 3.3 Soil Conservation

Objective

Quantify the relative importance of the processes associated with the soil-conservation potential of specific agroforestry methodologies in the semi-arid environment of the Sahel and on moderate to steep slopes in the subhumid and humid tropics

Project 3.4 Pest Management

Objectives

Monitor key pests and their natural enemies in specific agroforestry systems to gain an understanding of their population dynamics and their response to different technology-management strategies. Monitor weed populations and shifts in weed composition associated with the adoption of specific agroforestry systems

Programme 4: Systems Improvement

Project 4.1 Subhumid Highlands of East and Central Africa

Objective

Develop and evaluate agroforestry technologies that help to mitigate declining soil fertility, soil erosion and fodder storage and that contribute to the production of wood products and food from indigenous trees

Project 4.2 Subhumid Plateau of Southern Africa

Objectives

Develop and evaluate environmentally sound and economically viable agroforestry technologies that help to mitigate declining soil fertility shortages of fodder, fuelwood and construction poles, and that contribute to the production of food, particularly fruit. Develop agroforestry alternatives for the region's farmers who are practising shifting cultivation

Project 4.3 Semi-Arid Lowlands of West Africa (SALWA)

Objective

Develop and evaluate environmentally sound and economically viable agroforestry systems that mitigate wind and water erosion, enhance soil fertility, and address the problems of desertification, the constraints of fodder and water shortages and the issue of the management of farmed parkland (trees in cropped fields)

Project 4.4 Humid Lowlands of West Africa (HULWA)

Objective

Develop agroforestry systems that help to mitigate declining soil fertility, soil erosion and weed invasion and that provide acceptable alternatives to the current practice of shifting cultivation and the low level of system diversity

Project 4.5 Humid Tropics of Latin America

Objective

Develop and evaluate agroforestry systems that provide acceptable alternatives to slash-and-burn agriculture and that foster the regeneration of degraded fallows and tropical pastures and enhance their diversity

Project 4.6 Humid Tropics of Southeast Asia

Objective

Develop and evaluate agroforestry systems that could provide alternatives to slash-and burn agriculture and that could help to reclaim abandoned alang-alang grasslands

ANNEXE 3

PRESENTATION DU PROGRAMME 4 "SYSTEMS IMPROVMENT"

PROGRAMME 4: SYSTEMS IMPROVEMENT

The priorities and research agenda of this work have been determined following a thorough analysis of land-use systems and the potentials of agroforestry to address the constraints and opportunities that farmers experience. Research activities are grouped within six projects based on ecoregions that are representative of ICRAF's three priority agro-ecological zones. The main technologies in each ecoregion are indicated.

PROJECTS

4.1 Sub-humid Highlands of East & Central Africa
4.2 Sub-humid Plateau of Southern Africa
4.3 Semi-arid Lowlands of West Africa (SALWA)
4.4 Humid Lowlands of West Africa (HULWA)
4.5 Humid Topics of Latin America
4.6 Humid Topics of South-East Asia

System improvement research centres on the monitoring and evaluation of the long-term biophysical, ecological and economic impact of agroforestry technologies used as alternatives to current systems. This work is undertaken on research stations and on farms by multidisciplinary teams of scientists at a range of locations in many countries.

Outputs will include recommendations for technologies that will be tested on farm in collaboration with scientists working in ICRAF's Characterization and Impact Programme. The Systems Improvement research is working on a range of technologies for each ecoregion.

The priority systems currently being investigated address the prospects and constraints of alternatives to slash-and-burn agriculture, the reclamation of abandoned and depleted lands in the humid tropics, and land depletion in the savanna woodlands and agro-silvopastoral systems of the sub-humid and semi-arid tropics.

Inputs to the Programme include information originating from ICRAF's research on multipurpose-tree improvement and component interactions.

Ecoregion / Technology	Humid tropics			Sub-humid tropics		Semi -arid
	Humid Lowlands of West Africa	Latin America	S.E. Asia	Southern Africa	East & Central Africa	Lowlands of West Africa
Improved and Managed Fallows	x	x	x	x	x	
Hedgerow Intercropping	x			x	x	
Contour Hedges	x	x	x		x	x
Windbreaks						x
Silvopastoral Systems		x		x		
Fodder Banks	x		x	x	x	x
Grass/Shrub Strips					x	
Live Fences/Fence posts	x	x				x
Trees in Cropland	x			x		x
Taungya Systems		x	x			
Multi-strata Systems	x	x	x	x	x	
Trees on Boundaries			x	x	x	

RESOURCE ALLOCATION **Senior staff years (SSY)** **Amount in 1992 US$"000"**

Project	1994 SSY	1994 $	1995 SSY	1995 $	1996 SSY	1996 $	1997 SSY	1997 $	1998 SSY	1998 $
4.1	3.4	801	3.4	801	3.4	801	3.4	801	3.4	801
4.2	3.1	704	3.1	704	3.1	704	3.1	704	3.1	704
4.3	1.2	444	1.7	581	2.2	589	2.2	589	2.2	589
4.4	0.9	332	0.9	332	0.9	332	0.9	332	0.9	332
4.5	1.2	304	2.2	355	2.2	355	2.2	355	2.2	355
4.6	1.2	324	1.7	337	1.7	337	1.7	337	1.7	337
Total	**11.0**	**2,909**	**13.0**	**3,110**	**13.5**	**3,118**	**13.5**	**3,118**	**13.5**	**3,118**

SYSTEMS IMPROVEMENT

PROJECT 4.1 SUB-HUMID HIGHLANDS OF EAST AND CENTRAL AFRICA

Objective

Develop and evaluate agroforestry technologies which help to mitigate declining soil fertility, soil erosion and fodder shortage and which contribute to the production of wood products, and food from indigenous trees.

Activities

These will concentrate on the following technologies: contour hedges; improved fallows, grass/shrubs on bunds and boundaries; upper-storey/under-storey combinations on bunds and boundaries; upper-storey trees in banana plots; fodderbanks of shrubs and grass; and under-exploited indigenous fruit trees.

Outputs and indicators

- By 1994, recommendations of improved systems for producing fodder, diversified production through upper-storey trees, and the control of soil erosion will have been widely evaluated on farms.
- By 1994, on-station research for improved fallows will be established at three locations
- By 1994, the Ecoregional Highlands Initiative will begin operations.
- By 1995, researcher-managed on-farm trials of improved fallows and hedgerow intercropping for enhanced soil fertility will be helping to frame the range of sites where these technologies could be used successfully.
- By 1996, research trials on indigenous fruit trees, and their performance in multi-strata systems will have been established. In Uganda and Burundi, results from research on upper-storey trees in banana systems and in croplands and boundaries will have produced recommendations for on-farm evaluation.
- By 1998, recommendations for systems of improved fallows and hedgerow intercropping for soil fertility enhancement will be available for on-farm evaluation.

Impact

National institutions and development agencies will have been provided with recommendations that have the proven potential to address the major constraints associated with land depletion. These recommendations will be used by ICRAF and its research and development partners to guide on-farm technology testing and impact research.

PROJECT 4.2 SUB-HUMID PLATEAU OF SOUTHERN AFRICA

Objectives

Develop and evaluate environmentally sound and economically viable agroforestry technologies which help to mitigate declining soil fertility, shortages of fodder, fuelwood and construction poles, and which contribute to the production of food, particularly fruit. Develop agroforestry alternatives for the region's farmers who are practising shifting cultivation.

Activities

These will concentrate on the following technologies: improved and managed fallows; contour hedges; trees on boundaries; trees in cropland; and under-exploited indigenous fruit trees.

Outputs and indicators

- By 1994, recommendations for the management of live fences, fodder banks, improved fallows, hedgerow intercropping, and some under-exploited fruit trees will have been provided for on-farm testing and evaluation.
- By 1994, researcher-controlled on-farm trials of improved fallows and relay cropping will be established and will be helping to define the regions where they will work best.
- By 1995, research on alternatives to the slash-and-burn systems in Southern Africa will have been initiated at the benchmark location of Kasama, Zambia.
- By 1996, recommendations for trees on boundaries and in cropland, and for improvements in the management of silvopastoral systems will have been provided for on-farm testing and evaluation.
- By 1998, there will have been a significant devolution of programmes to selected NARS.

Impact

National institutions and development agencies will have been provided with recommendations that have the proven potential to diversify production systems and to contribute to ecological stability. Through the incorporation of useful indigenous trees into agroforestry systems, these recommendations have the potential to contribute to the maintenance of biodiversity.

SYSTEMS IMPROVEMENT

PROJECT 4.3 SEMI-ARID LOWLANDS OF WEST AFRICA (SALWA)

Objective

Develop and evaluate environmentally sound and economically viable agroforestry systems which mitigate wind and water erosion, enhance soil fertility, and address the problems of desertification, the constraints of fodder and water shortages and the issue of the management of farmed parkland (trees in cropped fields).

Activities

These will concentrate on the following technologies: windbreaks and contour planting; fodder banks; improved farmed parkland; and live fencing.

Outputs and indicators

- By 1994, research on fodder production, live fences, wind-erosion control systems and improved farmed parkland systems will be established in Senegal, Niger, Mali and Burkina Faso — on-station and using researcher-controlled trials in farmers' fields.
- By 1995, recommendations for the management of live fences and fodder banks will be available for on-farm evaluation.
- By 1996, a first set of recommendations for on-farm evaluation of contour planting of tree/shrub combinations for water erosion control will be available.
- By 1998, recommendations for the above will be refined and additional recommendations for the improved management of windbreaks and farmed parkland will be available for on-farm testing and evaluation.
- By 1998, recommendations on the use of fodderbanks to supplement animal nutrition will be available.

Impact

National institutions and development agencies will have been provided with recommendations that have the proven potential to diversify production systems and to make them more resilient to uncontrollable external factors such as drought. The work will also have identified where changes will need to be made to the current farmed parkland system of land use in order to ensure long-term ecological stability.

PROJECT 4.4 HUMID LOWLANDS OF WEST AFRICA (HULWA)

Objective

Develop agroforestry systems which help to mitigate declining soil fertility, soil erosion and weed invasion and which provide acceptable alternatives to the current practice of shifting cultivation and low level of system diversity.

Activities

These will concentrate on the following technologies: improved fallows; rotational hedgerow intercropping; contour hedges; and upper-storey trees in crop systems.

Outputs and indicators

- By 1994, to assist the targeting of on-farm testing and evaluation, on-station research and researcher-controlled on-farm trials of improved fallows and hedgerow intercropping will have defined the circumstances where these technologies will work best.
- By 1994, research trials on improved fallows, contour planting and multi-strata systems will have been established on the acid soils of the slash-and-burn benchmark site of Mbalmayo, Cameroon, and by 1996 initial results will be available.
- By 1997, research results originating from on-station and researcher-controlled on-farm studies of improved fallows and hedgerow intercropping will be published.
- By 1998, recommendations for species suitable for multi-strata systems will be used by ICRAF and its collaborators to design on-farm studies.

Impact

A raised awareness of agroforestry as a viable alternative to shifting cultivation, and information generated by the research will be making a significant input into the global initiatives that are seeking alternatives to this practice.

SYSTEMS IMPROVEMENT

PROJECT 4.5 HUMID TROPICS OF LATIN AMERICA

Objective

Develop and evaluate agroforestry systems which provide acceptable alternatives to slash-and-burn agriculture and which foster the regeneration of degraded fallows and tropical pastures and enhance their diversity.

Activities

These will concentrate on the following technologies: improved fallows; multi-strata systems; contour hedges; silvopastoral systems; live fence posts; and taungya with under-exploited indigenous fruit trees.

Outputs and indicators

- By 1994, research on improved fallows, contour hedges, multi-strata systems for fruit production and trees for live fence posts will have been established on-station and on-farm.
- By 1996, tree species for use as live fence posts and for fruit production will have been identified for sites in Brazil, Peru and Mexico, and recommendations for on-farm evaluation will be available.
- By 1996, a first set of research results will be available for improved fallows in Brazil, Peru and Mexico, and for erosion control by contour hedges in Peru and Mexico.
- By 1997, recommendations for tree species for use in the rehabilitation of degraded pastures will be available for testing and evaluation on-farm.
- By 1998, management strategies for improved fallows in Brazil, Peru and Mexico and for soil erosion control in Peru and Mexico will be available for evaluation on-farm.

Impact

Throughout the region, there will be greater awareness of the potential of agroforestry to improve the productivity and stability of degraded fallows and pastures and therefore to obviate the need for further deforestation. Similarly, a raised understanding of the potential of agroforestry systems as alternatives to slash-and-burn agriculture will be contributing to the global initiative that is seeking to slow down tropical deforestation and the adverse environmental effects associated with it.

PROJECT 4.6 HUMID TROPICS OF SOUTH-EAST ASIA

Objective

Develop and evaluate agroforestry systems which could provide alternatives to slash-and-burn agriculture and which could help to reclaim abandoned alang-alang grasslands.

Activities

These will concentrate on the following technologies: improved fallows; contour hedges; upper-storey/under-storey contour planting; multi-strata systems; taungya systems with timber, under-exploited indigenous fruit trees and estate crops; fodder banks and boundary planting.

Output and indicators

- By 1994, research on technologies to mitigate tropical deforestation and reclaim abandoned land will be established in Indonesia, Thailand the Philippines and Vietnam.
- By 1996, recommendations for contour hedges will be available for evaluation on farm in Thailand, the Philippines and Vietnam.
- By 1996, recommendations for fodder banks will be available for on-farm evaluation.
- By 1997, a selection of tree species suitable for taungya and multi-strata systems and boundary plantings will have been identified for testing and evaluation on farms.
- By 1998, recommendations for on-farm evaluation of improved fallows and upper-storey/under-storey combinations on contours will be available.

Impact

The potential of agroforestry to mitigate tropical deforestation and reclaim alang-alang sites will have been demonstrated and research results will be contributing to the global initiative that is searching for viable alternatives to slash-and-burn agriculture.

Table 11. Working groups and associated Indonesian institutions

Working groups	Member institutions
Policy	• AARD-CAER (Agricultural Research and Development Agency, Centre for Agroclimatic Research) • AFRD (Forest Research and Development Agency) • UNAND (Andalas University) • UNIBRAW (Brawijaya University) • Bappeda (national planning agency) • Bappedal (environmental planning agency) • BAN (cadastral mapping agency) • CRDB (Centre for Research and Design in Biology) • KLH (Ministry for Environment and Population) • RRL (Soil and Water Conservation Directorate) • Badan INTAG (Forest Inventory Directorate)
Alternative land use and biodiversity	• AARD • AFRD • NGOs • UNAND • UNIBRAW
Carbon and nutrient cycling	• AARD • AFRD • UNIBRAW • CRDB • UNAND
GIS/agro-ecosystems zoning	• AARD (CSAR, CRIFC) • Bakosurtanal (mapping agency)
Gas emissions	• AARD • AFRD (FRDC, FPRDC) • UNIBRAW • BPPT (Agency for Technology Assessment)

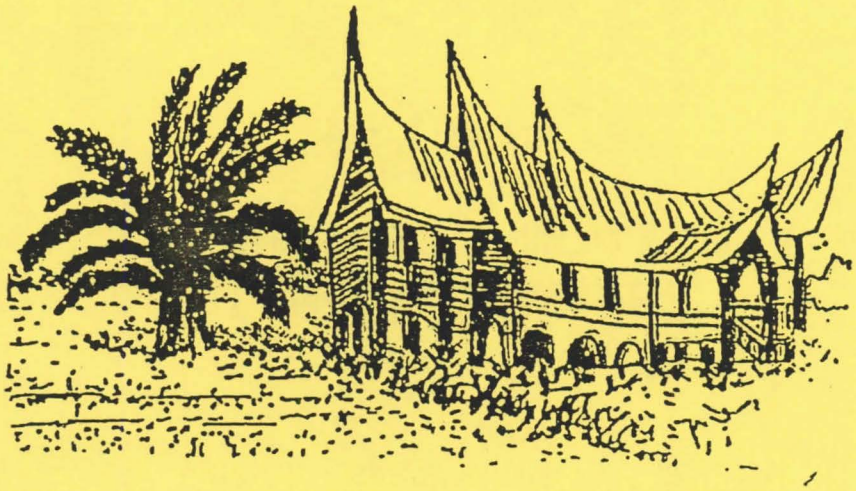
ANNEXE 4

PRESENTATION DU PROGRAMME 4.6
ASIE DU SUD EST

Eric Penot

ICRAF's
Southeast Asia Regional Research Program

"A Year of Building"



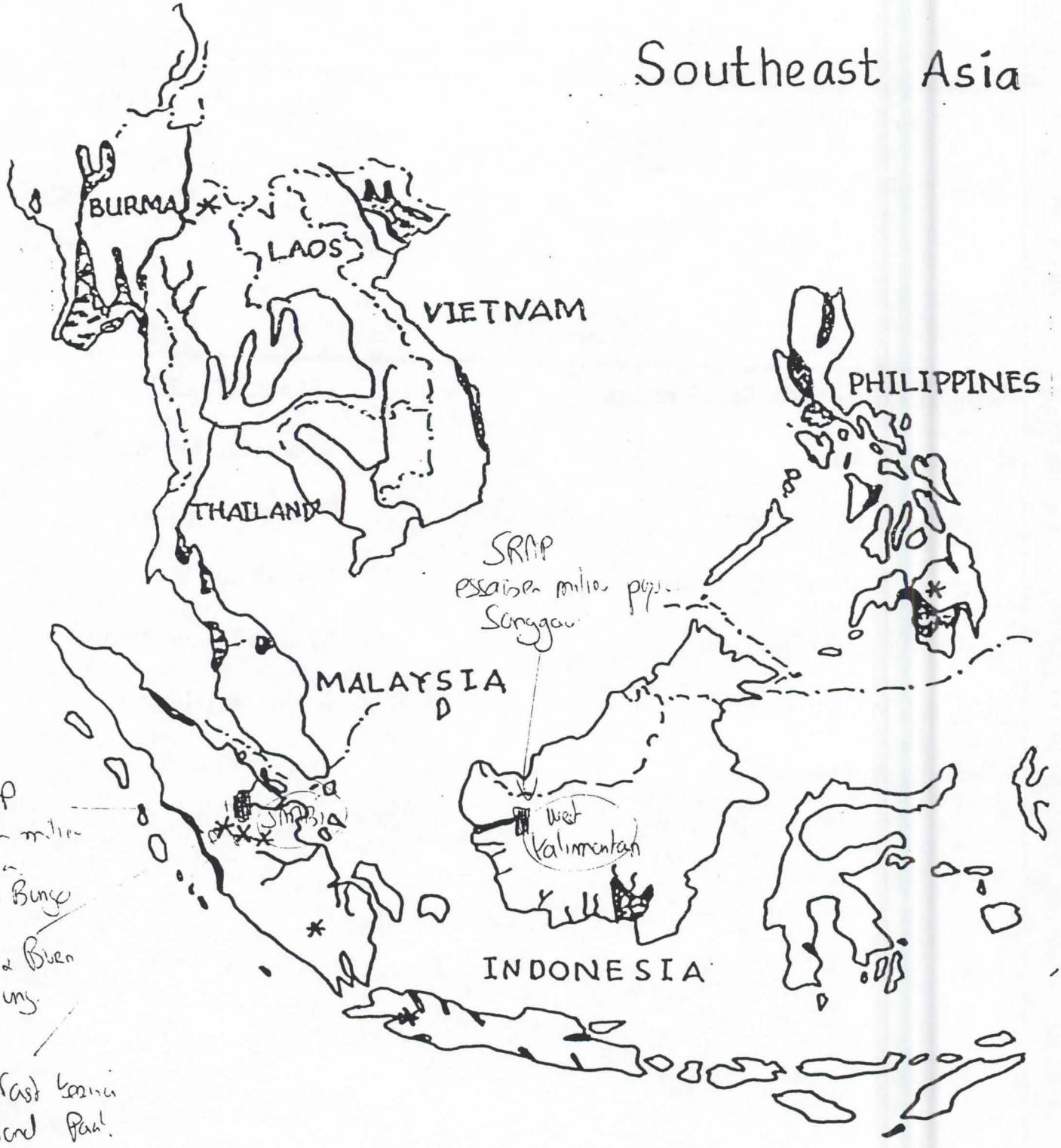
'Team Southeast Asia'

Sept 1993

Soil Scientist/Biologist	Meine van Noordwijk
Systems Agronomist	Dennis Garrity

Sept 1994

Natural Resource Policy Economist	Thomas Tomich
Forest Ecologist	Hubert de Foresta
Ethnobotanist/Ecologist	Genevieve Michon
Farming Systems Agronomist	Eric Penot
Social Forestry Specialist	Muljadi Bratamihardja
Soil Scientist/Biologist	Meine van Noordwijk
Systems Agronomist	Dennis Garrity


Southeast Asia
BURMA
LAOS
VIETNAM
PHILIPPINES
THAILAND
MALAYSIA
INDONESIA

Confirmed Sources of Support for ICRAF's Work in Southeast Asia 1994-95

Source	Activities
Core funding	General budget support
GEF/UNDP	ASB: ICRAF positions and national program support
ORSTOM	Staff secondment: 2 scientists
CIRAD	Staff secondment: 1 scientist
Ford Foundation	Social forestry project & Agroforests Working Group
ACIAR	Imperata project & Workshop
SANREM	Buffer zone AF research
Biodiversity Conserv Network /USAID	Dipterocarp AF project
IDRC	ASB thesis scholarship
ODA	Imperata Workshop
US Forest Service/USAID	Imperata Workshop/Manual

* Initiatives from SE Asia *

The Unifying Themes

Hypothesis 1: Forest Margins

"Complex agroforestry a superior alternative."

Initiative 1A -->	**Rubber agroforests: Improving their efficiency thru...**
	*** Improved clonal material**
	*** Improved intercropping (timber, fruit trees)**
	*** Improved policy support**

ICRAF Staff: Hubert de Foresta, Eric Penot, Thomas Tomich with Meine van Noordwijk, Dennis Garrity

Partners:

GAPKINDO (Rubber Processors Ass'n)
--logistics, financial support

Indonesian Rubber Research Institute
--clones and intercropping expertise

Forest Research and Development Centre
--timber trees in RAF

Food Crops Research/Sitiung
--trial mgmt in Sumatra

Social Forestry Dev Project (Min of For, GTZ)
--trial mgmt in West Kalimantan

Challenge: Donor funding to support trial network operating budget

Extraits du rapport annuel ICRA 1993

HUMID TROPICS OF SOUTHEAST ASIA

An astounding array of agroforestry systems is observed in Southeast Asia, evolving in response to market changes, new technical options and the inexorable pressure of more people on the land. These include the homegardens observed in Bangladesh and Indonesia; the millions of hectares of rubber and fruit agroforests of Sumatra and Kalimantan; government-fostered taungya systems of Burma, Thailand and Java; and the tree-cultured swiddens observed from Assam to Mindoro.

Widespread interest now exists in implementing upland agroforestry development programmes, often involving non-traditional land-tenure arrangements. In socialist (such as China and Vietnam) as well as in free-market economies (such as the Philippines and Thailand) major programmes are evolving that involve the transfer of millions of hectares of hilly land from government control to family farmers.

Agroforestry is now being promoted among decision-makers as an attractive conservation-oriented farming solution to sustain the productivity of fragile lands. Consequently, there is enormous demand for sound upland agroforestry technology, but there is also a major shortfall in the research needed to provide answers on how to do it.

ICRAF's Southeast Asian regional office, established in 1992, is located in the Forest Research and Development Centre of the Agency for Forestry Research and Development (AFRD). It is adjacent to those of the Asia-Pacific Agroforestry Network (APAN) and the global headquarters of CIFOR. Thus, the location enables ICRAF to collaborate closely with the FAO-sponsored network that supports agroforestry training and information dissemination in 10 Asian countries. In addition, it integrates ICRAF with the forest science community now assembling around CIFOR. We also have a direct link with the Indonesian agricultural science community centred in the many Bogor-based research institutions.

Three events have been important in guiding the development of the regional programme. The first occurred in August 1992, when a team of four ICRAF scientists joined 10 Indonesian colleagues from forestry and agricultural research institutions for a site-selection exercise to prospective locations to make recommendations on an appropriate site at which to base research on the ASB initiative. This is to be one of eight benchmark sites around the tropics.

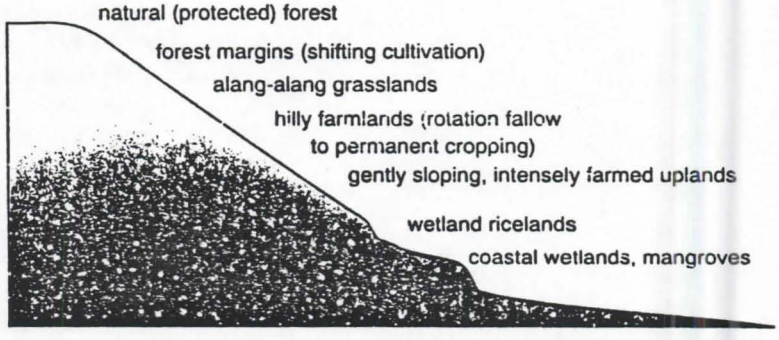


Figure 33. A generalized landscape ecology of southeastern Asia.

Second, a global workshop on research methodology was hosted by ICRAF in Southeast Asia in February–March 1993 in Bogor, with field diagnostic work in central Sumatra. Third, in April–May 1993 we conducted an international training course, 'Land-Use Systems Research Methodology for the Humid Tropics of Asia'. Two prospective research sites were characterized during the fieldwork (a bush-fallow rotation area on the boundary of Kerinci Seblat National Park and a new transmigration site in Sitiung, both in Sumatra).

AN ECOSYSTEM FOCUS

The landscape ecology of much of Southeast Asia follows a broadly similar pattern along a decreasing elevational gradient. In a 'typical' watershed the land-use pattern may be characterized as in figure 33. Although such a model is highly simplified, it is useful in conceptualizing the ecosystems and their interactions for research and development planning.

The remnants of primary forests are generally present only at the highest elevations (for example, primary forests are seldom observed at less than 800 m elevation in the Philippines). The boundary of the forest margin is constantly moving upward because of forest conversion, accelerated by slash-and-burn. Behind the forest margins are extensive grasslands, which evolved after shifting cultivation and are maintained in a fire climax. Most of them are dominated by *Imperata cylindrica* (alang-alang, cogon, lalang) and are essentially abandoned or have very limited use.

At lower elevations closer to the roads, the hilly lands are more densely populated. Here, rotation-fallow systems are evolving into more permanent cropping systems. This zone grades into more gently sloping, intensively farmed uplands. Wetland rice is produced in the alluvial valleys from the uplands to the broad lowland river basins. Agroforestry is important in the rice-growing areas as homegardens and bund planting. The coastal wetlands include large areas of mangroves, which allow for unique forms of agroforestry.

This pattern repeats itself dependably enough to provide a landscape ecosystem model. This model helps define relationships among landscape components and can be useful to help clarify research needs. While in Latin America the spatial issue is mainly a function of distance from the road or river, in Southeast Asia it is a function of landscape.

Target ecosystems in the medium term will be limited to forest margins, grasslands and hilly farmlands. The prospective research sites for the ASB initiative have been selected to represent these landscape components.

AGROFORESTRY SYSTEMS HYPOTHESES

The conceptual framework for our research in the target ecosystems is based on three agroforestry systems hypotheses. We have identified one principal hypothesis to guide our efforts in each ecosystem. Table 37 summarizes the hypotheses upon which research will be based.

Systems Hypothesis 1. On the forest margins, complex 'agroforests' provide a superior alternative for small-scale farmers to either food-crop systems or monoculture plantations of perennials. As alternatives to slash-and-burn, complex agroforests increase production sustainability, increase biodiversity, reduce production risks and increase returns to labour when compared with the models of continuous food crops or monoculture plantation crops.

Two predominant models have been promoted for sustainable settlement of the forest margins in Southeast Asia. The first might be termed the 'continuous food-crops model'. It is based on the premise that with appropriate soil and crop management practices, continuous annual cropping could be practised sustainably on infertile Ultisols and Oxisols. The Trans-

Table 37. ICRAF's research strategy in Southeast Asia—three systems hypotheses

	Forest margins	Grasslands	Hillslope farmlands
Hypothesis	agroforests are superior to sole food crops or monoculture estate crops	reforestation is most effectively achieved through agroforestry	natural vegetative strips act as a foundation for soil erosion control and agroforestry
Research location	indigenous communities pioneer communities	pioneer communities	permanent farms
Ecogeographic target			
equatorial	Indonesia	Indonesia	—
midlatitude	—	Philippines	Philippines
mainland	—	Thailand	Thailand

migration Programme of Indonesia has widely employed this premise for the past two decades, and it continues to be the basis for new settlement in many locations. The record of research and actual experience by both government-subsidized and spontaneous settlers, as well as indigenous peoples, has indicated that this model of sustaining profitable small-scale food cropping on these soils is seldom feasible.

An alternative model, given particular emphasis during the past decade, is the 'monoculture estate crops model'. It has received strong support from international development banks. This model involves the development of estates to replace natural forest or slash-and-burn farming. Small-scale farmers receive 1–2 hectare parcels on an estate designated for monoculture rubber or oil palm, with a guaranteed market.

These schemes that are tree and crop based avoid some of the problems of earlier land-development models, but they still lack the flexibility and crop diversity of traditional forest-farming strategies. New concerns have arisen with these models, particularly:

- the high degree of risk farmers face, because their source of livelihood is a single commodity
- the loss of biodiversity associated with replacing a natural forest with a monocultural plantation; other instabilities observed with the loss of biodiversity in the production system are the likelihood of increased pest infestation, with the threat of dependence on pesticide inputs

A mounting body of studies on the agroecology of the farming systems of indigenous communities on the forest margins has provided strong indications that there is a middle ground between continuous annual cropping and monoculture plantations. Solutions developed by farmers have been evolving among some rural communities. These centre on the development of agroforests or complex agroforestry systems.

Some 'agroforest' models that exemplify these solutions include

- the 2.5 million hectares of 'rubber agroforests' in Indonesia, which produce 75% of the country's rubber
- the cultivation of dipterocarp timber trees in several types of agroforestry systems, including the damar systems based on *Shorea javanica*, which produce commercial resins for export
- the diverse array of fruit agroforestry systems, including the durian forest gardens of West Kalimantan and the cultivation of rattan in swidden fallows in East Kalimantan

These systems have been described and documented. Now urgently needed are a more quantitative understanding of their agroecology, the ability to predict how they can be extrapolated and agronomic improvements that will upgrade their productivity.

In building a research programme around the 'agroforest hypothesis' ICRAF seeks to build a deeper empirical database and working models on the agroecology of these systems. This is aimed to guide decisions on when, where and how the development of complex agroforestry systems is preferable to other simpler options. We are assembling a collaborative research team that will strive to develop methods to guide the numerous local research and

Smallholders produce 75% of Indonesia's rubber in complex agroforestry systems, or rubber agroforests, which tend to contain numerous fruit and timber species and often resemble natural secondary forests in their biodiversity.

development teams that are now forming. These teams are seeking to understand, promote and improve agroforest models for their specific agroecosystems. Methods specifically applicable for doing this do not yet exist. But practical guidelines and insights will be valuable, provided they are based on the solid experience of a team that has worked with a view to methodological development.

Over a longer term, the complex-agroforest team will identify the technological constraints to improving the productivity of these systems. This will direct research toward developing better germplasm and management practices for agroforests.

An important question here is under debate: How relevant is the agroforestry experience of mature, indigenous communities (where many of the most promising prospective agroforestry solutions have developed) to the dramatically different circumstances of pioneer cultivators, who are responsible for most of the current pressure on the land? One view is that, in some cases, complex agroforests are a transitional stage at low population density, and as intensification increases, system complexity will necessarily decrease. We recognize that conclusive answers are not yet known, but they are crucial. ICRAF considers it essential to target the research to two situations:

- mature communities with promising agroforest solutions
- pioneer communities facing the challenge of how to proceed toward sustainable systems

A key field research area selected for our work on the agroforest hypothesis is the watershed of the Hari River in West Sumatra, Indonesia. The work will be focused in two locations in the watershed: a pioneer settlement recently established in lowland rainforest on sloping Ultisols in Sitiung, and a mature Minangkabau settlement practising annual cropping under bush-fallow rotation on the boundary of the Kerinci Seblat National Park in the upper watershed. The latter site will enable us to apply the hypothesis to buffer-zone management for a major national park.

The research effort will be conducted by a consortium of institutions funded through the ASB initiative. The consortium will include universities, NGOs and the national research centres for forestry (Forest Nature Conservation Research and Development Centre) and for farming systems on acid soils (Central Research Institute for Food Crops) and international institutions (IRRI, CIFOR and ICRAF). Our methodology will emphasize farmer-participatory research, complemented by researcher-managed investigations.

Systems Hypothesis 2. The rehabilitation of alang-alang grasslands through small-scale agroforestry systems will be superior to plantation reforestation in terms of production, equitability and participation objectives.

The alang-alang (*Imperata cylindrica*) grasslands of southeastern Asia represent a vast underutilized natural resource, covering an area exceeding 40 million hectares. This species (known as 'alang-alang', 'cogon' and 'lalang' in local languages) takes over after slashed and burned fields are abandoned and is maintained through frequent fires. Plantation reforestation, particularly the many projects sponsored by national forest departments, has had mixed success. Only a small proportion of the trees survive to maturity, because of either fire, poor site conditions or lack of care. Increasingly, interest in land-use alternatives for these grasslands focuses on active participation of local people. In adopting small-scale agroforestry systems the World Bank has estimated that the economic benefits to farm families and to the national economy substantially exceed those from shifting cultivation or large-scale industrial timber plantations.

Little systematic knowledge exists on the rehabilitation of degraded grasslands. Often ignored is the reality that the presence of alang-alang grasslands is symptomatic of a complex interaction of human and environmental factors. A more holistic understanding of the agroecosystem is essential to develop practical and comprehensive ways of managing and exploiting the potential of these lands.

There are important examples of farmers rehabilitating alang-alang grasslands. Agroforestry systems have been notably effective in rehabilitating grasslands in eastern Indonesia. But fundamental land-tenure requirements for rehabilitation across the range of alang-alang ecosystems must be emphasized.

Timber prices are increasing rapidly in southeastern Asia. This is encouraging small-scale farmers to grow trees for sale. Hundreds of farmers in the southern Philippines are

planting such species as *Gmelina arborea, Peraserianthes falcataria* and *Acacia mangium*. They are intercropping the trees in contour lines with their annual field crops. Preliminary observations indicate that the establishment of timber trees by small-scale farmers has several unique advantages:

- Land preparation and weeding costs in the initial years are charged to the annual crops, making tree establishment and maintenance cheap and effective compared with large-scale plantation methods.
- The cropped alleyways between trees provide fire breaks that drastically reduce wildfire damage.
- Small-scale farmers' more intensive field management better insures that the trees will make it to harvestable age.

The results of recent experiments at Central Luzon State University in the Philippines lend support to this concept. Three MPTS (*Acacia mangium, A. auriculiformis* and *Gliricidia sepium*) were grown in monoculture and as intercrops with annual crops (upland rice and mungbean) on a well-drained, mixed isohyperthermic Udic Haplustalf of clay loam texture. The treatments also compared side-branch pruning as a management practice to reduce light competition with the field crops.

The incorporation of a multipurpose tree into an annual crop system increased the income-generating potential of the system (fig. 34). Net returns over a 2-year period were substantially higher in the pruned tree-crop intercropping treatment (USD 1278). They were lowest (USD 702) in the monoculture tree system. With side-branch pruning, net income from the annual– perennial system after two years was 30% higher than from the sole annual crop system.

In 1994, we are initiating a systems analysis of the alang-alang ecosystems in Indonesia to classify the grasslands into a limited number of contrasting ecosystems, appraise current knowledge on practical agroforestry systems for rehabilitating grasslands in a range of ecologies and

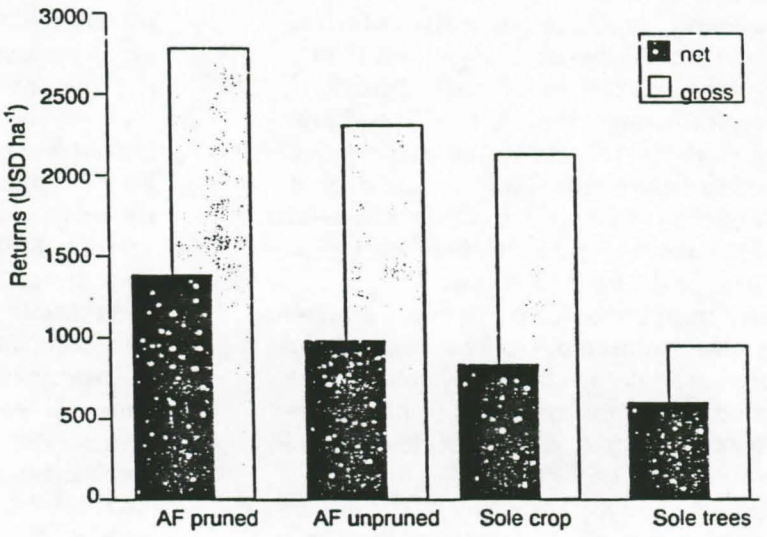


Figure 34. The incorporation of a multipurpose tree into an annual crop system increased income generation. With side-branch pruning, net income from the annual–perennial system after two years was 30% higher than from the sole annual crop system. Data from Central Luzon State University–IRRI–ICRAF collaboration.

develop a framework for long-term research in this area.

This work will be done through a 2-year collaborative research project funded by ACIAR. It is being implemented by a working group of ICRAF, Australian and Indonesian scientists from several institutions.

Systems Hypothesis 3. On hillslope farmlands there are several pathways to sustainable small-scale farming. Among these, contour hedgerow systems initiated through natural vegetative strips (NVS) provide distinct advantages as a superior, low-cost foundation upon which to build agroforestry-based conservation farming.

Annual crop production is common on millions of hectares of hilly land in nearly every country in southeastern Asia. Much of this land is on slopes that range from 15 to 90%, with documented rates of soil erosion that typically range from 50 to 300 t ha^{-1} $year^{-1}$. If urgent efforts to stabilize these soil resources are not successful, the resulting land degradation and wasted farms will further impoverish rural populations and exacerbate settlement pressure on the forest margins.

Alley cropping based on contour hedgerows of pruned leguminous trees has been promoted for over a decade in several countries as a solution to the problem. Contour hedgerow systems have demonstrated an effective ability to reduce soil losses, but farmers have not widely adopted the systems. The constraints to adoption include the intensive labour requirements to install and periodically prune and maintain the hedgerows, and unanticipated problems in sustaining soil fertility. The classic alley-cropping model is now being widely promoted, but ICRAF researchers recognize that it has serious limitations in some situations.

Grass strips have received major attention as contour vegetative barriers for erosion control in different parts of the world. However, two major problems have surfaced with their use. Often, their high biomass production leads to serious competition for resources with the adjoining food crops, particularly as the grass is usually pruned for cut-and-carry fodder, and the nutrient yield is removed from the field. Second, if they are allowed to grow tall, they shade adjacent crops, but slashing them to keep them short takes a lot of labour.

A new approach that has received little attention is the installation of NVS. These are narrow contour strips of field area left unploughed and allowed to vegetate naturally. These natural grasses may be suppressed by grazing, slashing or mulching with crop residue.

Isolated observations were made that some upland farmers preferred this method of establishing contour vegetative barriers. Researchers then began to work to understand the potential role of NVS. Recent data from Claveria, Mindanao, indicate that they provide excellent erosion control, with negligible installation and maintenance costs, and exert minimal competition with the associated annual crops. As the strips capture sediment and develop into terraces they also provide a foundation for agroforestry. Income-generating cash perennials are planted on the risers along with fodder or green manure species. We hypothesize that the strips are a convenient way to evolve toward more sustainable annual cropping, with a gradually increasing farm area in perennials. Farmer

experience with natural vegetative strips in two municipalities in the Philippines suggests that the concept deserves wider evaluation. But several important issues need to be resolved.

How can soil fertility be maintained in the upper alleyways as terraces form, and how does incorporation of cash perennials affect the food crop and the overall system productivity? Subsequent pathways to sustainable farming will involve management systems based on nutrient recycling, nutrient regeneration or nutrient importation. These options have yet to be scientifically explored.

We will also need to address the issue of how and where to extrapolate the natural strip concept. For this we are developing a decision support system in collaboration with a Philippine soil scientist, for use on the farm. Farmers will evaluate natural strip technology using participatory research methodology.

ICRAF will seek to develop collaborative research with other institutions to explore the strategic implications of natural vegetative strips as a foundation for agroforestry-based conservation farming on hillslope farms. Our partnerships in this area currently involve the Tropical Soils Program (TropSoils) at North Carolina State University, and faculty and students at two Philippine universities. The work will also be a major theme of our involvement in the SANREM consortium working at our key site in Mindanao.

Regional ecogeographic focus

The three systems hypotheses we are investigating are each strongly related to a particular ecosystem. Each hypothesis also has geographic implications (table 37). As one proceeds north from the equator in southeastern Asia the upland climate generally becomes harsher with longer, drier dry seasons, cooler winters and a greater threat of tropical storms. Northward along this gradient are also ecological conditions that are associated with slower establishment of vegetation, lower primary productivity and a greater tendency for upland soils to lack ground cover for substantial portions of the year. The ecoregions along the gradient may be recognized as

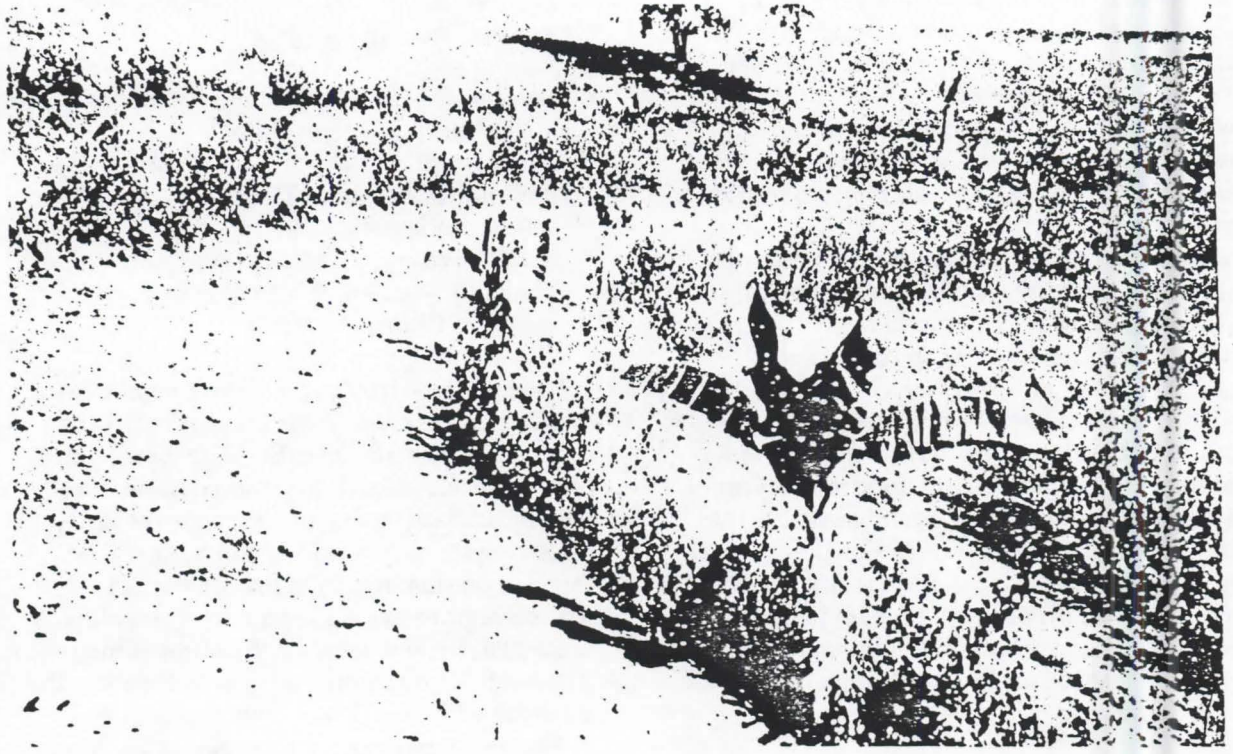
- ***equatorial tropics*** (5° S–5° N) Indonesia, Malaysia, Papua New Guinea
- ***mid latitude wet-dry tropics*** (5–15° N) Philippines, southern Thailand and southern Vietnam
- ***northern tropics*** (15–22° N) northern Thailand, Vietnam, Myanmar, Laos and southern China

The equatorial tropics is where the major remaining forests exist. These are particularly concentrated on the islands of Sumatra, Borneo and New Guinea. Research to protect natural forestland by addressing the intensification of agroforestry systems on the forest margins will be targeted predominantly to the equatorial tropics. The strategic research site tentatively identified is the Hari River watershed in central Sumatra. The full ICRAF scientific team in Indonesia will be involved in research on hypothesis 1.

The northern tropics encompasses the huge east-west belt of hilly lands in the interior of mainland southeastern Asia, reaching from Assam to Vietnam and southern China. The climate is strongly monsoonal with long, dry winters that are slightly cooler than the equatorial tropics. The land-use problems in this zone

contrast sharply with those of the equatorial tropics. Major land degradation in the upland watershed areas has resulted from agricultural intensification on steep terrain. The global ASB initiative has selected northern Thailand as a key research site. It is centrally located in the uplands running through four neighbouring countries and has the most favourable scientific infrastructure to support strategic research and training. Systems hypotheses 2 and 3 are particularly relevant for ICRAF's focus in the ASB research consortium based there. It is proposed that ICRAF build a team of 2–3 scientists in northern Thailand to provide adequate scientific effort for this ecosystem.

The midlatitude tropics are a transitional zone. Research work in the Philippines builds upon the support of ICRAF's strong relationship with the Upland Ecosystem Programme of IRRI and SANREM CRSP, a long-term initiative



Natural vegetative strips are created by allowing unplanted strips of land to revegetate naturally along the contour. Their excellent erosion control properties, lack of competitiveness with associated annual crops and low requirement of labour for maintenance are features attractive to farmers. ICRAF research is evaluating them for more widespread use as a foundation for agroforestry.

of USAID. The work will be conducted in the Manupali watershed in northern Mindanao.

Thus, our plan for research sites focuses on three dominant locations: the equatorial tropics (Sitiung, Sumatra, Indonesia), the northern tropical hill country (Chiang Mai, Thailand) and the midlatitude tropics (Mindanao). The ecosystem continuum at each of the three research locations will enable ICRAF to employ a landscape approach in its research. Work in the forest margins, grasslands and hillslope farmlands at one major site in each ecogeographic region will allow us to engage in comparative analysis and to better extrapolate our findings across the region.

We will phase the initiation of research activity at our key sites. During the first half of 1993 the Philippine site became fully operational, and two site characterization activities were conducted at the Indonesian site. Field research in Indonesia was initiated during the second half of 1993. Research at the northern tropical hill country site in Thailand is scheduled to begin in late 1994.